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The impact of Intellectual Capital on Firms' Characteristics: an empirical analysis on European listed manufacturing companies

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Abstract

This work aims at advancing knowledge about the relationship among Intellectual Capital (IC), firms' performances and market value by investigating 10-year data gathered from a sample of manufacturing companies listed on the Euronext Stock Exchange. An exploratory study was designed to: (i) highlight linkages amidst the IC components and (ii) show the consistence of the ties amongst IC, financial performance and firm's value variables. Findings highlighted that: (i) Structural Capital (SC) and Relational Capital (RC) impacted directly on firms' performances and that (ii) only SC, within a certain time horizon, had significant effects on firms' market value. The research demonstrates that, even in the manufacturing industry, IC can have an important impact on performances. This study could be useful for scholars, who aims at deepening knowledge about the linkage between IC and financials, and for practitioners, to figure out how investments in Intellectual Capital should be addressed to get better financial performances and a higher market value.

Key words*: Intellectual Capital, Financial Performances, Market Value, Euronext*

1. INTRODUCTION

During the last decades, the modern Economy has been changing quickly due to the increasingly usage of knowledge-based resources that have revolutionised the way of competing in new marketplaces chiefly characterised by many threats (i.e. technological, financial, etc.) [1, 2].
Following these new market changes, firm market value cannot be evaluated taking account only by using tangible resources but also by adding the "intangible value". To date, knowledge-based resources, represented by the Intellectual Capital resources, often "replaces" the traditional ones: land, capital and work [3-7].
Many authors have focused their attention on the asymmetry between the market and the book value stating that one of the main elements that influence firm market value is the Intellectual Capital [4, 8-10]; therefore, it has become interesting to study the relationship between it and Market Value.
By looking the past literature, results of different analysis shed light on the fact that there is a "hidden value" that, though it cannot be easily gathered observing only financial statements, it is able to create competitive advantage, particularly in new dynamic markets [11-14].
Thus, the wide acceptance of the Intellectual Capital as a source of competitive advantage leaded many authors to carry out methodologies that strove to measure this "hidden value", recognising the fact that the traditional accounting and financial measures are not able to show it [15, 16] representing only a (tangible) part of the "real" firm value. According to [11] and [17], if a market is considered as efficient, investors ascribe a higher value to the firms (obviously operating in that

market) having a high value of Intellectual Capital resources.

This work aims to investigate the relationship amidst the Intellectual Capital, firm performance and market value by measuring separately the effects of: (i) Intellectual Capital investments on firm financial performances; (ii) Intellectual Capital investments on market value; (iii) Firm financial performance on market value. Furthermore, before analysing those relationships, the internal connections between the three components of IC (Human Capital, Structural Capital, Relational Capital) were investigated.

The paper is organised as follow: in its first part, literature regarding the Intellectual Capital (IC) is examined in order to constitute the conceptual base to define the IC-variables to be used during the analysis; in the subsequent part, the research framework, results and discussions are displayed; finally conclusions and future works are presented.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Intellectual Capital (IC) has been widely studied by many academics and practitioners [18-21] who have acknowledged its great importance within the context of firms' performance evaluation since the studies in [4] and [12]. Even though there are a lot of definitions of IC, one of the most accepted divides it into three main components: (1) experience, knowledge, intellect, behaviour, relationship, attitude and special skills of the personnel altogether forming the Human Capital - HC [22, 23]; (2) non-human storehouses of knowledge existing in organisations or a general system of problem solving and innovation altogether forming the Structural Capital - SC [24]; (3) the value generated by inter-organisational relations or relations existing between the firm and (e.g.) suppliers, customers, shareholders and other institutions and individuals [24, 25] altogether forming the Relational Capital – RC.

A great number of studies approached the analysis of the possible nexus between IC and business performances focusing on the correlation level between different components of the IC. [26] gave a seminal contribution in this direction. Based on a survey of The University of Western Ontario MBA students, his study identified a number of causal chains by which the HC can positively impact the firm's performances through both SC and customer capital. He found that higher correlation between the IC components leads to better firm performances with estimated levels of correlation of 0.52 between HC and SC, 0.40 between SC and performances, and 0.56 between customer capital and performances.

Several studies applied Bontis' approach in different empirical contexts. [27] found that the IC, in the form of reputation and organisational culture especially, tends to positively affect the performances of Israeli public authorities. [28] found a positive link between IC and financial performances of US firms as intangible resources positively relate to the persistence of profits. [29] estimated the effect of IC on business performances of German pharmaceutical firms acting through the channel of intellectual property (i.e. new patents and brands development) – i.e. they found lower levels of correlation than Bontis' (0.23 in this case) both between SC and intellectual property and between SC and performances in terms of market leadership. [30] analysed different measures of the IC based on advertising and R&D estimating rises of 2.54 and 1.54% associated with the Tobin's Q ratio of pharmaceutical and chemical US firms. [31] analysed a sample of Portuguese banks estimating correlation levels of 0.76 between HC and SC; 0.40 between both HC and RC and between SC and RC; 0.43 between SC and performances; and finally, 0.29 between RC and performances.

Some studies investigated the relationship between specific investments in infrastructures and IC and after between IC and financial performance. [32] studied how the use of cloud-based accounting/finance infrastructure affects the business performance in SMEs. They found that the investment in the infrastructure has a positive and statistically significant impact on human and relational capital. Furthermore they found that all the three components of IC positively influence performance. [33] found that management accounting systems positively impact on human and structural dimensions of IC and that structural capital positively and directly influences performance.

[34] empirically tested the relationship between IC and business performance in the pharmaceutical sector in Jordan. They found a statistical significance for the hypothesized relationship. [35] investigated the relationship between intangible investments and the ability to generate operating cash flows: they found a positive result for the hypothesized relationship. [10] empirically studied the gap between market and book value. They found that not all the difference between the two values can be explained by intangibles, but a significant portion is due to external factors not related to the management of the firm.

Other studies were developed by [36], who provided a framework in which the relationship between intellectual capital (in particular R&D expenditures) and financial performance of listed biotech firms were analysed. [37] discussed how Intellectual Capital is related to human, organizational, relational and financial capital using a case study of a firm that invests in human, structural and relational capital. [38] developed a

framework for wood Argentine companies by using items related both to the three IC dimensions and firms' performances (measured by: output, cash flows, profit, yield, market value, equity, competitive advantage, professionalism of the employees, productivity, reduction of costs, transference of new technologies and modernisation of the facility innovation capacities). [39] found a positive and significant influence of the IC, that according to the authors is composed by Human capital and Structural capital, on the financial performance of the firm.

[40] studied the gap existing among IC components and business performance (industry leadership, future outlook, net profit, liquidity ratio, ROE, banking income, cost-income ratio, overall response to competition, success rate in new product/service launches, overall business performance and success) within banks of Luxemburg and Belgium. [41] investigated how Intellectual Capital Reports allow analysts to implement a more homogeneous rating assessment.

[42] and [43] introduced a new approach to estimate the effect of IC on business performances based on the VA generated by the use of the different components of IC and capital employed. This approach provides a measure of total efficiency called VAIC. Several studies adopted the VAIC, testing the effects of the IC on performances measured by (e.g.) profitability, productivity and market valuation [17], financial results [11, 44-51] or organisational improvements [52]. In some case, these studies found a positive relationship between IC and financial performances.

In particular [11, 44, 48, 50, 51, 53, 54], according to Pulic's standpoint, showed that Intellectual Capital positively contributes to firms' performances measured by profitability (i.e. ROI, ROE, etc.) and/or market-based proxies (i.e. FCFO, FCFO/Sales, Market-to-Book value, etc.).

[55] carried out a study in which Pulic's scheme was extended to the other components of Value Added. They found that IC-related efficiency gains of 1% can raise the ROA up to 0.7% and the cash flow to operating revenues up to 21.1%.

Building on these studies, in this paper we formulated different sets of hypotheses. From an overall point of view we aimed at testing whether these studies' findings hold when a different sample of firms and different measures of business performance and market value are used. More specifically we hypothesized the existence of the following relationships:

1. there is a relationship amongst the three components of IC (HC, SC, RC)
2. IC investments positively affect firm performance
3. IC investments positively affect market value
4. there is a relationship between firm performance and market value.

In order to test our hypotheses we carried out an empirical research on a sample of European companies (listed on Euronext 100) operating in different industries. In the following section the research framework is described.

3. RESEARCH FRAMEWORK: HYPOTHESES, DATASET, VARIABLES

3.1 Hypotheses

Given the objective of investigating the relationship amongst Intellectual Capital (IC), firms' performances and market value (MV), the research framework was constructed by implementing specific sub-hypotheses for each of the supposed relationship described at the end of the previous section. Hypothesis **1** is related to the first hypothesized relationship, amongst the three components of IC (HC, SC, RC):

Hp. 1: There is a relationship (in terms of correlation) amongst the three IC components (HC, SC, RC);

- **Hp. 1.a**: There is a relationship between HC and SC;
- **Hp. 1.b**: There is a relationship between SC and RC;
- **Hp. 1.c**: There is a relationship between HC and RC;

Subsequently, the research moves forward to examine the relationships between Intellectual Capital Investments (ICI) and firms' performances, according to the second hypothesis at the end of the previous section (IC investments positively affect firm performance) and furthermore the relationship between ICI and market value, according to the third hypothesis (IC investments positively affect market value). The hypotheses H2, H3, H4 and H5 are introduced. In particular H2 and H4 are related to the second hypothesis while H3 and H5 are related to the third one. The difference is that the two hypotheses are constructed respectively on different time horizons for input and output. Finally, the two hypotheses H6 and H7 are introduced with specific reference to the supposed relationship described in the fourth point of the previous section (relationship between performance and market value).

For this analysis a time horizon of 10 years was used. This choice is justified by the expected effects of Intellectual Capital Investments: as a matter of fact, it is presumable to think that they have impact only considering a medium/long time horizon. So the considered time horizon (10 years) was split up in two intervals: in the first the investment in IC were considered and in the second interval the firm performance and market

value are considered. Actually, the firm performance and the market value have to be considered as "results" of the investments. Furthermore, in order to deepen the analysis, two different lengths for the intervals were selected and then the hypotheses were doubled. In particular the different time range are:

- First "cut" of the time horizon:
  - ICIs: 2003 – 2007
  - Firm performance: 2008 – 2012
  - Market value: 2008 - 2012
- Second "cut" of the time horizon:
  - ICIs: 2003 – 2009
  - Firm performance: 2010 – 2012
  - Market value: 2010 - 2012

So, the hypotheses can be described in detail as follows.

Hp. 2: The ICI made during the period 2003-2007 positively affect firm performance over the period 2008-2012

Hp. 2.a: The Human Capital Investments (HCI) made during the period 2003-2007 positively affect firm performance over the period 2008-2012

Hp. 2.b: The Structural Capital Investments (SCI) made during the period 2003-2007 positively affect firm performance over the period 2008-2012

Hp. 2.c: The Relational Capital Investments (RCI) made during the period 2003-2007 positively affect firm performance over the period 2008-2012

To what concern the relationship between IC and firm's market value, the research follows these hypotheses:

Hp. 3: The ICI made during the period 2003-2007 positively affect firm market value over the period 2008-2012

Hp. 3.a: The Human Capital Investments (HCI) made during the period 2003-2007 positively affect firm market value over the period 2008-2012

Hp. 3.b: The Structural Capital Investments (SCI) made during the period 2003-2007 positively affect firm market value over the period 2008-2012

Hp. 3.c: The Relational Capital Investments (RCI) made during the period 2003-2007 positively affect firm market value over the period 2008-2012

The hypotheses H4 and H5 are similar respectively to H2 and H3 with the only difference of considering a longer period for ICI (2003-2009 instead of 2003-2007) and a shorter for performance and market value; thus, they are:

Hp. 4: The ICI made during the period 2003-2009 positively affect firm performance over the period 2010-2012

Hp. 4.a: The Human Capital Investments (HCI) made during the period 2003-2009 positively affect firm performance over the period 2010-2012

Hp. 4.b: The Structural Capital Investments (SCI) made during the period 2003-2009 positively affect firm performance over the period 2010-2012

Hp. 4.c: The Relational Capital Investments (RCI) made during the period 2003-2009 positively affect firm performance over the period 2010-2012

Hp. 5: The ICI made during the period 2003-2009 positively affect firm market value over the period 2010-2012

Hp. 5.a: The Human Capital Investments (HCI) made during the period 2003-2009 positively affect firm market value over the period 2010-2012

Hp. 5.b: The Structural Capital Investments (SCI) made during the period 2003-2009 positively affect firm market value over the period 2010-2012

Hp. 5.c: The Relational Capital Investments (RCI) made during the period 2003-2009 positively affect firm market value over the period 2010-2012

The last step consists of seeking a possible relationship between the overall performance and the value of firm, according to the fourth hypothesis of the previous section (there is a relationship between firm performance and market value).The following hypotheses were defined:

Hp. 6: firm performance obtained during the period 2008-2012 positively affect firm market value (on the same time horizon)

Hp. 7: firm performance obtained during the period 2010-2012 positively affect firm market value (on the same time horizon)

The framework containing all the hypotheses above mentioned is showed in the Figure 1 below:

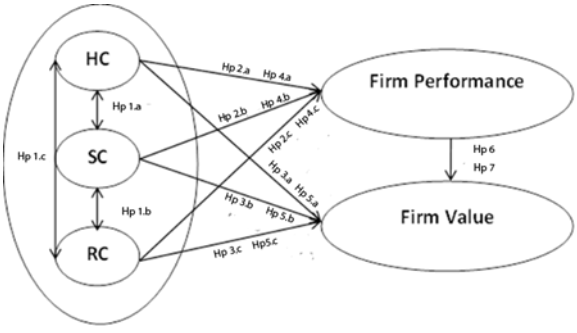

Figure 1: Conceptual Research Framework

3.2 Dataset

The sample used in this research is made up of 45 firms listed on Euronext stock exchange.

The choice of using Euronext 100 is justified by the willingness of looking at the investments made by European Companies in Intellectual Capital. This paper aims at making clear how investments into IC components might be related to the improvement of firms operating into the European Marketspace.

Before choosing 45 companies, there have been analysed all the 100 firms listed in Euronext 100. In a first step, the choice was based on the value of the stock market index Euronext 100 that represents the 100 titles having the highest capitalisation and most actively negotiated on Euronext. After a deeper analysis, however, we realized that IC-related items are not commonly disclosed by companies (as even noticed by [40]). Therefore, there were chosen firms that disclose such kinds of data[1]. The 10-year data (from 2003 to 2012) have been harvested from Thomson Reuters DATASTREAM database.

Table 1 describes the sample as a whole:

Industry: Energy and Chemicals Industry (13 firms)				
Shell	Total	EDF	Schneider Electric	ASML Holding
Galp Energia	Sanofi	Air Liquide	Essilor	Legrande
Veolia Environment	DSM	Solvay		
Industry: Consumer Goods & Retail Industry (10 firms)				
Ab_Inbev	Heineken	L'Oréal	Unilever	Danone
Kering	Carrefour	Ahold Kon.	Jéronimo Martins	Pernod Ricard
Industry: ICT (7 firms)				
Philips	France Télécom S.A.	Vivendi	Dassault Systèmes	Iliad
KPN	Gemalto			
Industry: Engineering and Aerospace & Defense (11 firms)				
EADS	Bureau Veritas	Vinci	Saint-Gobain S.A.	Lafarge
Renault	ArcelorMittal	Michelin	Technip	STM
Vallourec				
Industry: Services Marketing (4 firms)				
Publicis Groupe	Sodexo Alliance	Accor	JC Decaux	

Table 1: The Sample

3.3 Variables

Seven independent variables have been defined by the authors, according to the literature regarding Intellectual Capital and firms' performance evaluation [36-40]. They describe the three components of the IC (HC, SC and RC). More in details, such variables have been derived from previous studies and adapted for the purpose of this research. In particular, the variables chosen and the source in the literature are described in Table 2.

[1] Some companies do not disclose reports about Intellectual Capital to not reveal strategic information that could favor their competitors

Macro-variable	Variable	Description	Derived from
	Cost of Employees / No. Employees	It is the average cost of personnel consisting of salaries paid to the employees including benefits and contributes of them. High values of this index means there is higher staff remuneration than that of the market due either to nature of contracts or to the prevalence of high-skilled employees.	[37]; [39]
	Training Hours / No. Employees	It represents the number of training hours for each employee. It could be interpreted as the commitment of an organisation to invest in human capital by defining training courses aiming at raising employees' productivity and creativity.	[36]; [37]
	Intangible Assets / Total Assets	It is the percentage of the intangible assets available in a certain organisation. Intangibles are made up of resources often classified as Intellectual Property Resources like patents, marks, copyrights, brands, etc. A high value of this ratio means there is a high Structural Capital within an organisation.	[39]
	R&D / Sales	It represents the quantity of Sales invested in R&D activities. This ratio depends not only by the willingness of an organisation to invest in R&D but also by the industry in which an organisation operates and by the technological advancement of that sector (i.e. pharmaceutical companies generally have a higher value for this ratio due to the high technological advancements in the sector in which they compete).	[36]; [39]
	R&D / No. Employees	It is the expression of the R&D cost associated to each employee. This ratio makes possible to evaluate the impact of R&D activities on a single employee, assuming that each of them is involved in that those activities.	[36]
	Sales / No. Employees	It is the percentage of Sales generated by each employee; thus it is a sort of productivity index of each employee.	
	Universities and other Partnerships	It is a binary indicator (Yes/Not). It represents the existence of relationships amidst organisations, universities, research centres, etc. These relationships aim both at enhancing the capacity of innovating of an organisation and solving environmental issues.	[38]
	EBITDA / Sales	It is a profitability index that represents the percentage of EBITDA generated by the Sales.	[39]; [40]
	Cash ROCE = EBITDA / Capital Employed	It is the percentage of EBITDA generated by the investments made by an organisation. This indicator is useful to identify companies having high growth capacities.	[38]; [40]
	Market to Book ratio = MV / BV	It is used to investigate the gap existing between MV, calculated as share price * number of shares, and the BV (net book value of assets – net book value of liabilities). The concept underlying this ratio is that the gap between MV and BV is due to the "real" value of intangible resources.	[38]
	EV / EBITDA	It is a market multiple referring to the incomes. It represents the Enterprise Value (Equity + Debts) generated by the companies operating margins/incomes.	

Table 2: The specific variables chosen for IC, performance and market value

4. THE COMPUTATIONAL ANALYSIS

4.1 Models

To what concerns the analysis carried out to investigate the hypotheses above displayed (in section 3), the first step was related to the quantification of all variables (both belonging to IC and financial measures); the variables were considered with an annual frequency. Afterwards, the obtained results showed that variables had different measure units; thus the authors proceeded to a standardisation (in a range [1; 10]) according to the *min-max criterion*. The min-max normalization is the most used technique able to bring values having different measure units to a

unique and common scale[2]. The technique has been widely used in several different applications. For a wide description of the method and applications see for example [56].
After having standardised the variables' values, the following step was devoted to the computation of two approaches:

- Correlation analysis, to mainly highlight linkages amidst IC variables (*Hp. 1.a, Hp. 1.b, Hp. 1.c*)
- Linear regression, to show the consistence of the ties amongst IC, financial performance and firm market value variables.

Linear regressions were designed to scan the supposed relationships 2, 3 and 4 at the end of section 2. The general formulation of the linear regressions are as follows. Equation 1 is related to the hypothesized relationship between IC and firm performance (IC investments positively affect firm performance), equation 2 is related to the hypothesized relationship between IC and market value (IC investments positively affect market value), equation 3 is related to the hypothesized relationship between firm performance and market value (there is a relationship between firm performance and market value):

Equation 1:

$$\textbf{\textit{Firm Performance}} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE} + \beta 2 * \frac{Training\ Hours}{NE} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets} + \beta 4 * \frac{R\&D}{NE} + \beta 5 * \frac{R\&D}{Sales} + \beta 6 * \frac{Sales}{NE} + \beta 7 * University\&Environmental\ Partnership + \varepsilon$$

Equation 2:

$$\textbf{\textit{Firm Market Value}} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE} + \beta 2 * \frac{Training\ Hours}{NE} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets} + \beta 4 * \frac{R\&D}{NE} + \beta 5 * \frac{R\&D}{Sales} + \beta 6 * \frac{Sales}{NE} + \beta 7 * University\&Environmental\ Partnership + \varepsilon$$

Equation 3:

$$\textbf{\textit{Firm Market Value}} = \beta 0 + \beta 1 * EBITDA/Sales + \beta 2 * Cash\ ROCE + \boldsymbol{\varepsilon}$$

Dependent and independent variables have been computed by their average values over the period considered in the particularized models.
As already stated in section 3.1, two different "cut" for the time horizon were considered. In the following, models 1.1 and 1.2 refer to equation 1 for the first cut of the time horizon, models 2.1 and 2.2 refer to equation 2 for the first cut of the time horizon, models 3.1 and 3.2 refer to equation 1 for the second cut of the time horizon, models 4.1 and 4.2 refer to equation 2 for the second cut of the time horizon:

Model 1.1

$$\boldsymbol{EBITDA/Sales}_{\textbf{avg2008-2012}} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg 2003-2007}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg 2003-2007}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg 2003-2007}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg 2003-2007}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg 2003-2007}} + \beta 6 * \frac{Sales}{NE}_{\text{avg 2003-2007}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2007}} + \varepsilon$$

Model 1.2

$$\boldsymbol{Cash\ Roce}_{\textbf{avg2008-2012}} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg 2003-2007}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg 2003-2007}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg 2003-2007}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg 2003-2007}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg 2003-2007}} + \beta 6 * \frac{Sales}{NE}_{\text{avg 2003-2007}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2007}} + \varepsilon$$

Model 2.1

$$\boldsymbol{MV/BV}_{\textbf{avg2008-2012}} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg 2003-2007}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg 2003-2007}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg 2003-2007}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg 2003-2007}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg 2003-2007}} + \beta 6 * \frac{Sales}{NE}_{\text{avg 2003-2007}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2007}} + \varepsilon$$

[2]The min-max normalization is best suited for the case where the bounds (maximum and minimum value) of the score produced by a matcher are known. The min-max formula is shown below:

$$\boldsymbol{y'm = \frac{ym - min}{max - min}(max' - min') + min'}$$

where, taking account of a series y: *y'm* is the value that we would obtain; *ym* is the pattern m where m = 1,.., M; *min* is the minimum value in the series of values; *max* is the maximum value in the series of values; *max'* is the maximum value of the predetermined range (that we would get); *min'* is the minimum value of the predetermined range (that we would get)

Model 2.2

$$EV/EBITDA_{avg2008\text{-}2012} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg 2003-2007}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg 2003-2007}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg 2003-2007}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg 2003-2007}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg 2003-2007}} + \beta 6 * \frac{Sales}{NE}_{\text{avg 2003-2007}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2007}} + \varepsilon$$

Model 3.1

$$EBITDA/Sales_{avg2010\text{-}2012} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg 2003-2009}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg 2003-2009}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg 2003-2009}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg 2003-2009}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg 2003-2009}} + \beta 6 * \frac{Sales}{NE}_{\text{avg 2003-2009}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2009}} + \varepsilon$$

Model 3.2

$$Cash\ ROCE_{avg2010\text{-}2012} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg 2003-2009}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg 2003-2009}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg 2003-2009}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg 2003-2009}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg 2003-2009}} + \beta 6 * \frac{Sales}{NE}_{\text{avg 2003-2009}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2009}} + \varepsilon$$

Model 4.1

$$MV/BV_{avg2010\text{-}2012} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg2003-2009}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg2003-2009}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg2003-2009}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg2003-2009}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg2003-2009}} + \beta 6 * \frac{Sales}{NE}_{\text{avg2003-2009}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg 2003-2009}} + \varepsilon$$

Model 4.2

$$EV/EBITDA_{avg2010\text{-}2012} = \beta 0 + \beta 1 * \frac{Cost\ Of\ Employees}{NE}_{\text{avg2003-2009}} + \beta 2 * \frac{Training\ Hours}{NE}_{\text{avg2003-2009}} + \beta 3 * \frac{Intangible\ Assets}{Total\ Assets}_{\text{avg2003-2009}} + \beta 4 * \frac{R\&D}{NE}_{\text{avg2003-2009}} + \beta 5 * \frac{R\&D}{Sales}_{\text{avg2003-2009}} + \beta 6 * \frac{Sales}{NE}_{\text{avg2003-2009}} + \beta 7 * University\&Environmental\ Partnership_{\text{avg2003-2009}} + \varepsilon$$

In the following, the models introduced refer to equation 3. Models 5.1 and 5.2 are related to the "first" hypothesis of time horizon while models 6.1 and 6.2 are related to the second hypothesis of time horizon. Even in this case, variables have been computed according their average values over the different time horizons.

Model 5.1:

$$MV/BV_{avg2008\text{-}2012} = \beta 0 + \beta 1 * EBITDA/Sales_{avg2008\text{-}2012} + \beta 2 * Cash\ ROCE_{\ avg2008\text{-}2012} + \boldsymbol{\varepsilon}$$

Model 5.2:

$$EV/EBITDA_{avg2008\text{-}2012} = \beta 0 + \beta 1 * EBITDA/Sales_{avg2008\text{-}2012} + \beta 2 * Cash\ ROCE_{\ avg2008\text{-}2012} + \boldsymbol{\varepsilon}$$

Model 6.1:

$$MV/BV_{avg2010\text{-}2012} = \beta 0 + \beta 1 * EBITDA/Sales_{avg2010\text{-}2012} + \beta 2 * Cash\ ROCE_{\ avg2010\text{-}2012} + \boldsymbol{\varepsilon}$$

Model 6.2:

$$EV/EBITDA_{avg2010\text{-}2012} = \beta 0 + \beta 1 * EBITDA/Sales_{avg2010\text{-}2012} + \beta 2 * Cash\ ROCE_{\ avg2010\text{-}2012} + \boldsymbol{\varepsilon}$$

4.2 Correlation Analysis

As it has been argued previously, in the first instance, the authors carried out a correlation analysis (considering the different time horizons) to start measuring the kind and the intensity of the relationships amidst the variables. To conduct this analysis, it has been used the Pearson coefficient calculated by IBM SPSS Statistics v21; results are depict in Table 3.

Table 3 highlights a significant correlation (ρ = 0,599) between the average cost of personnel and *R&D/NE*, this means that for a firm the greater the investments made in R&D the higher the qualification of its employees, consequently, cost of personnel is higher. This association results coherent with the *Hp 1.a*

Correlation Analysis												
		CostofEmployees/NE	***TrainingHours/NE***	***IATA***	***R&D/Sales***	***R&D/NE***	***Sales/NE***	***UniversityPartnership***	***MV/BV***	***EV/EBITDA***	***EBITDA/SALES***	***CashROCE***
	Pearson	1										
	N	44										
	Pearson	,109	1									
	N	31	32									
	Pearson	-,256	-,178	1								
	N	44	32	45								
	Pearson	,128	-,159	,177	1							
	N	36	27	37	37							
	Pearson	,599**	,045	-,199	,123	1						
	N	36	27	37	37	37						
	Pearson	,379*	,117	-,396**	-,116	-,010	1					
	N	44	32	45	37	37	45					
	Pearson	-,292	-,283	,012	-,255	-,275	,141	1				
	N	44	32	45	37	37	45	45				
	Pearson	-,085	-,247	,137	,042	,220	-,047	-,309*	1			
	N	44	32	45	37	37	45	45	45			
	Pearson	,279	-,077	-,219	,068	,665**	,049	-,128	,244	1		
	N	44	32	45	37	37	45	45	45	45		
	Pearson	,181	,127	,350*	,440**	,040	-,078	-,282	,182	,042	1	
	N	44	32	45	37	37	45	45	45	45	45	
	Pearson	,115	,277	-,043	-,140	-,040	,259	-,291	,591**	,020	,206	1
	N	44	32	45	37	37	45	45	45	45	45	45
****correlation is significant at the level 0,05 (2-tails)***												
***** correlation is significant at the level 0,01 (2-tails)***												

Table 3: Correlation Analysis considering the periods 2003-2007 (independent variables) and 2008-2012 (dependent variables)

To what concerns the *Hp. 1.c*, it is verified by the positive correlation (ρ = 0,379) between the average cost of personnel and the average revenue (Sales) per employee.

By contrast, the *Hp 1.b*, related to the possible relation between *Intangible Assets/Total Assets* (*IATA*) and *Sales/NE* has not been verified as demonstrated by the negative correlation (ρ = -0,396).

Furthermore, another negative correlation (ρ = -0,309) has been identified in the relationship between *University and Environmental Partnership* and *MV/BV*. This finding seems to contrast what it was stated by the *Hp 3.c* (investing in Relational Capital could result in a better firm evaluation within the stock market); however, such considerations are investigated deeply through the regression analysis.

Regarding the possible relations involving Structural Capital, it has been noticed a positive correlation (ρ = 0,665) between *R&D/NE* and *EV/EBITDA*. Observing the relationships amongst independent and dependent variables referring to the firm performance, it has been found that *EBITDA/Sales* has positive relations both with *Intangible Assets /Total Assets* and *R&D/Sales* respectively ρ = 0,350 and ρ = 0,440. Such correlations are inclined to support the *Hp 2.b* (positive affections provided by Structural Capital Investments on Firm Performance).

Concerning the relationships amidst firm performance and market value, *Hp 6* is partially verified; in fact, correlation analysis shows a positive linkage (ρ = 0,591) between *MV/BV* and *Cash ROCE*, which would demonstrate (partially) the hypothesis beforehand mentioned.

In conclusion, insights emerged from the correlation analysis (referring to the periods 2003-2007 for independent variables and 2008-2012 for dependent ones) highlighted a link amongst intangible resources belonging to the Structural Capital both with firm performance and firm market value variables.

In the same way, in order to investigate the hypotheses *Hp. 4*, *Hp. 5*, and *Hp. 7*, a correlation analysis using values obtained for the periods 2003-2009 for independent variables and 2010-2012 for dependent ones has been carried out and results are summarised in Table 4.

As it can be noticed, the correlation analysis almost produced the same results previously found even considering an extended time horizon for the independent variables. Insights show that *Cost of Employees/NE* is positively correlated both with *R&D/NE* (ρ = 0,612) and *Sales/NE* (ρ = 0,409); furthermore, there is a positive relation between *Intangible Assets/Total Assets* and *Sales/NE* (ρ = 0,411) and a negative correlation between *University and Environmental Partnership* and *MV/BV* (ρ = -0,388). Another negative relation involves *Training Hours/NE* and *EV/EBITDA* (ρ = -0,380); this tends to contrast the hypothesis claiming that an increase of Human Capital positively affect the firm's value (*Hp. 5.a*).

The *Hp. 4.b* seems to be verified by the positive correlation coefficient (ρ = 0,299) between *Intangible Assets/Total Assets* and *EBITDA/Sales*. By contrast, it has been registered that *University and Environmental Partnership* is negatively related to both *EBITDA/Sales* (ρ = -0,371) and *Cash ROCE* (ρ = -0,335); these insights could reject the *Hp. 4.c*; thus, these are deeply explored by using regression analyses.

The cases concerning the negative correlation between partnerships and financial ratios should be further analysed due to the nature of the partnership-related variables and generally to a lack of a standardised approach in disclosing IC measures/variables. In fact, by analysing financial reports, it was noticed that firms tend to not clearly disclose how they measure the value of partnerships apart from yes/no relationships with Universities or other partners. As in the first correlation analysis (Table 3), it could be concluded that the hypothesis claiming that there are positive affections of the Structural Capital both on firms' performance and firm's value have been confirmed; consequently, from a strategic perspective, these relations emphasise the increasing tendency of investing in R&D and empowering the Intellectual Property (IP) by the firms taken into account.

Similarly, to what happened to *Hp. 6*, *Hp. 7* seems to be partially verified as demonstrated by the correlation coefficient (ρ = 0,591) between *MV/BV* and *Cash ROCE*. In addition, Table 4 showed a positive relationship (i) between *EV/EBITDA* and *MV/BV* (ρ = 0,313) and between (ii) *Cash ROCE* and *MV/BV* (ρ = 0,609), as expected.

Correlation analysis												
		CostofEmployees/NE	***TrainingHours/NE***	***IATA***	***R&D/Sales***	***R&D/NE***	***Sales/NE***	***UniversityPartnership***	***MV/BV***	***EV/EBITDA***	***EBITDA/SALES***	***CashROCE***
	Pearson	1										
	N	44										
	Pearson	,162	1									
	N	31	32									
	Pearson	-,283	-,252	1								
	N	44	32	45								
	Pearson	-,270	-,112	,100	1							
	N	37	27	38	38							
	Pearson	,612**	,089	-,175	,181	1						
	N	36	26	37	37	37						
	Pearson	,409**	,154	-,411**	-,126	-,012	1					
	N	44	32	45	38	37	45					
	Pearson	-,248	-,192	-,100	,247	-,263	,154	1				
	N	44	32	45	38	37	45	45				
	Pearson	-,089	-,311	,149	,018	,299	-,098	-,388**	1			
	N	44	32	45	38	37	45	45	45			
	Pearson	-,297	-,380*	,186	,056	,011	-,223	,039	,313*	1		
	N	44	32	45	38	37	45	45	45	45		
	Pearson	,167	,072	,299*	,051	,113	-,077	-,371*	,111	-,090	1	
	N	44	32	45	38	37	45	45	45	45	45	
	Pearson	,157	,258	-,132	-,079	,210	,258	-,335*	,609**	-,330*	,184	1
	N	44	32	45	38	37	45	45	45	45	45	45
****correlation is significant at the level 0,05 (2-tails)***												
***** correlation is significant at the level 0,01 (2-tails)***												

Table 4: Correlation Analysis considering the periods 2003-2009 (independent variables) and 2010-2012 (dependent variables)

4.3 Regression Analysis

Results coming from the correlation analysis allowed the authors to highlight the existence of linkages among ICI and dependent variables (firms' performances and firm's value) beforehand defined. The next step concerned into testing the hypotheses by using multiple linear regression models (displayed in the section 4.3) implemented by IBM SPSS Statistics v21.

Within the analysis, it was observed each variable for each company as it can be noticed by looking at the hypothesised models; therefore, there were made 45 observations for each dependent variable and 45 observations for each independent variable. The following table 5 displays a summary of the regression analyses conducted in this work, which are related to the hypotheses beforehand mentioned in the research framework:

Model	Dependent Variable	R^2	Significant variables	BETA	Sig.
			IATA	0,376	0,038
			R&D/Sales	0,468	0,017
Model 1.2	Cash ROCE	0,489	Sales/NE	0,721	0,005
Model 2.1	MV/BV	0,279	-	-	-
Model 2.2	EV/EBITDA	0,677	R&D/NE	0,840	0,000
			IATA	0,241	0,056
			R&D/Sales	0,771	0,000
Model 3.2	Cash ROCE	0,474	Sales/NE	0,57	0,022
			Training Hours/NE	-0,415	0,045
			R&D/NE	0,423	0,092
			Cost of Employees/NE	-0,475	0,051
			Training Hours/NE	-0,472	0,010
			University Partnerships	-0,525	0,007
Model 5.1	MV/BV	0,354	Cash ROCE	0,578	0,000
Model 5.2	EV/EBITDA	0,002	-	-	-
Model 6.1	MV/BV	0,371	Cash ROCE	0,609	0,000
Model 6.2	EV/EBITDA	0,110	Cash ROCE	-0,325	0,034

Table 5: Summarised results of the regression analyses

Paying attention to the table above, in the model 1.1, *R&D/Sales* and *Intangible Assets/Total Assets (IATA)* are significant predictors. Such results confirm positive relations previously emerged from the correlation analysis and, as a consequence, the hypothesis arguing that Structural Capital positively affects Firm Performance. The model 1.1 has a $R^2 = 0,600$; in this sense, it is able to explain the 60% of the variability of the *EBITDA/Sales* (dependent variable).

Within the model 1.2 shows that the variable *Sales/NE* is statistically significant in determining *Cash ROCE* ($\beta = 0,721$ and Sig. = 0,005). Further, this model has a $R^2 = 0,489$. Thus, this model identifies a relation between Relational Capital and Firm Performance.

To what concern the model 2.1, $R^2 = 0,279$; thus, this could be considered as a confirmation of what it has been found previously with the correlation analysis (there were no correlations between IC and market value). By observing the output showed in table 6, it can be noticed that there are no significant predictors for *MV/BV*, hence, this model does not verify the hypotheses *Hp 3.a, Hp 3.b, Hp 3.c*.

In the model 2.2, *R&D/NE* (belonging to the Structural Capital) is the only significant predictor ($\beta = 0,840$) for the *EV/EBITDA*. This can be considered as a confirmation of the relation previously observed in the correlation analysis; further, the model has a good adaptation to the data according to what it has been stated by the $R^2 = 0,677$.

Summarising the results just exposed, it could be argued that the Structural Capital is the IC component able to affect, to a greater extent, both firm's value and firms' performances. Furthermore, a positive relation between Relational Capital and Cash ROCE. In conclusion, the hypotheses *Hp. 2.b, 2.c* and *2.b* are partially confirmed.

After it has been verified the regression analysis, considering the extended time horizon for the independent variables (2003-2009) and the reduced timeframe for the independent ones (2010-2012) (Models: 3.1, 3.2, 4.1, 4.2).

By modifying the two-time horizons (for independent and dependent variables), it can be noticed that the model 3.1 is featured by a better adaptation to the data, as demonstrated by a higher R^2 compared with the model 1.1.

Furthermore, the regression analysis confirmed the *Hp. 4.b* (related to the relations between SC and firms' performances), meaning that *R&D/Sales* is a good predictor if *EBITDA/Sales* is considered as dependent variable.

By investigating the results deriving from the model 3.2, it can be observed that the R^2 is almost the same to that of the model 1.2; thus, even in this case, a positive affection of the RC upon firm performance appears to be supported. As a matter of fact, *Sales/NE* has a significant positive impact on *Cash ROCE*.

Moving towards the model 4.1, it is possible to note that there is a negative relationship between HC and *MV/BV*, particularly considering *Training Hours/NE*. Thus, the *Hp. 5.a* has been not verified; whereas to what concern the *Hp. 5.b* it can be argued that there is a positive relation between *R&D/NE* and *MV/BV*. A negative linkage between *MV/BV* and *Training Hours/NE* shows that training hours do not directly affect the firm's market value. A justification may lie on the fact that investments in training hours can be directed towards a more efficient productive environment (i.e. in terms of production processes); however, in terms of market value costs, such kinds of investments might result in higher costs that can impact negatively on market value. Similar considerations might be done to what concern negative relations between *Cost of Employees/NE* and *EV/EBITDA*. Generally, HC investments can impact more on costs, as investments made by companies to enhance productive processes; however, they can be negatively related to firms' market value due to their "cost nature".

The model 4.2 confirmed what it has just been said for the model 4.1, adding another negative relation between RC (*University Partnership*) and firm market value (*EV/EBITDA*); thus, the hypotheses *Hp. 5.a* and *5.c* has been partially denied. Despite the negative relation (*University Partnerships* and *EV/EBITDA*), this case should be further analysed due to the nature of *University Partnership* variable. Within the analysed financial reports, partnerships were not clearly disclosed apart from yes/no relationships; in fact, one of the issues found in this analysis is that each company discloses IC variables differently. Such issue is even more emphasised when searching for partnership-related variables since they have not a clear expression in terms of financial data.

The last step of this analysis was to verify the hypotheses H6 and H7, related to a possible relation between firm performance and firm market value.

Models 5.1 and 6.1 showed a significant positive linkage between *Cash ROCE* and *MV/BV*, then considering either the first timeframe (2008-2012) or the second one (2010-2012); whereas no relations have been found in the model 5.2.

Concerning the model 6.2, it has been discovered a negative link between *Cash ROCE* and *EV/EBITDA* within the period 2010-2012; this could means that in a short period Cash ROCE could impact negatively upon market value indicators (particularly on EV/EBITDA); whereas if a longer period is considered, a positive impact can be found; thus, in conclusion, this kind of relation should be investigated looking at longer periods than shorter ones.

5. DISCUSSION

The empirical analysis carried out in this work highlighted a positive impact, although limited, of the IC upon firm performance and market value.
Thus, an internal correlation amongst the IC components has emerged within both periods 2003-2007 and 2003-2009; it can be displayed as follows (Figure 2):

Figure 2 highlights which specific indicators, among those defined in this study and belonging to HC, SC and RC, have had a reciprocal impact to each other. However, no positive relations have been detected between SC and RC as hypothesised by the *Hp. 1.b*.

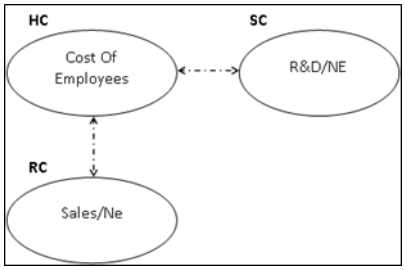

Figure 2: internal correlation amidst IC components

To what concern the relation amidst IC and firms' performances, results have demonstrated that SC and RC respectively are the IC components able to impact mostly on firm performance.

It is noteworthy that R&D investments are particularly relevant as confirmed also by the study carried out by [57], who showed as R&D expenses have positive effects on firm profitability and market value and, further, these allow analysts to acquire information about structural assets. In addition, this study confirms the relations found within the Bank industry by [31] who argued that HC has a positive impact on SC, RC and that these two IC components affect positively firm performance. ……

Furthermore, it has been observed that the value of *MV/BV*, considering the first timeframe (2008-2012 for the dependent variables), was not influenced by the IC investments. However, in the second period (2010-2012 for the dependent variables) the same indicator (*MV/BV*) was negatively affected by the investments in HC and RC; thus, the empirical analysis does not support what the authors have previously hypothesised. Considering *EV/EBITDA* as indicator of firm's market value, the analysis showed a lack of direct linkages with IC with the exception of SC, which affected positively *EV/EBITDA*, partially confirming what hypothesised (*Hp. 5.b*).

A reason that could explain this result may lie into the fact that Intellectual Capital investments, initially, could not have high positive impact on market value, despite a positive relation with SC has been found. In fact, when an organisation decides to make an investment like these mentioned, it increases its costs (i.e. Cost of employees); consequently, market value could not grow in the periods immediately following those investments. Further, firm market value does not depend only by the financial context but also by the market expectations. In fact, as demonstrated by [48], market expectations have radically changed starting from 2008, in which many firms viewed their market value decreasing, despite they had improved their financial results. It is possible that the impact of market expectations on market value after 2008, due to the financial crisis, was more emphasized than before. This effect could have influenced our analysis. Anyway, for the aim of our research it has to be registered here that changes occurred into market value are also linked to external factors rather than IC and financial investments only.

Summarising, in the following Table 6 results concerning the confirmation of the hypotheses are reported.

As it can be seen by the Table 6 above and the two figures (Figure 3 and Figure 4), correlations and regressions analyses did not verify all the hypotheses made by IC literature. As beforehand mentioned, Intellectual Capital investments could not affect positively market value and/or firms' performances immediately, despite positive relationships have been discovered.

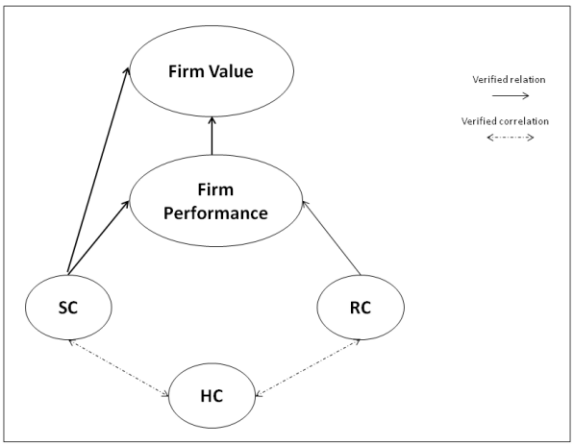

Figure 3: verified relations and correlations in the first timeframe

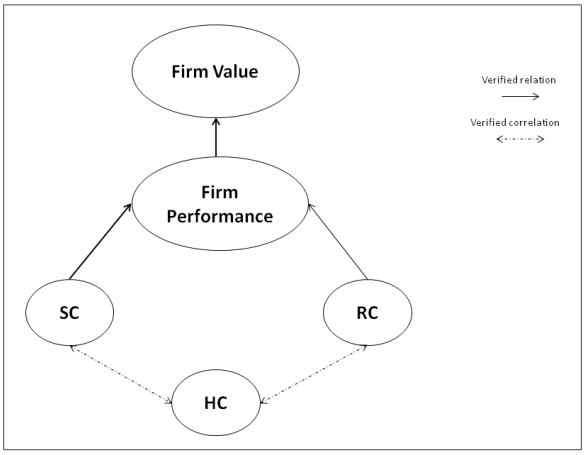

Figure 4: verified relations and correlations in the second timeframe

Hypothesis	*IC component*	*Influenced index (firm performance and market value)*
	Cost of Employees	-
	Training Hours/NE	-
	IATA	**EBITDA/Sales**
	R&D/NE	-
	R&D/Sales	**EBITDA/Sales**
	Sales/NE	**Cash ROCE**
	University & Environmental Partnership	-
	Cost of Employees	-
	Training Hours/NE	-
	IATA	**EV/EBITDA**
	R&D/NE	-
	R&D/Sales	-
	Sales/NE	
	University & Environmental Partnership	-
	Cost of Employees	-
	Training Hours/NE	-
	IATA	-
	R&D/NE	-
	R&D/Sales	**EBITDA/Sales**
	Sales/NE	**Cash ROCE**
	University & Environmental Partnership	-
	Cost of Employees	-
	Training Hours/NE	-
	IATA	-
	R&D/NE	-
	R&D/Sales	-
	Sales/NE	-
	University & Environmental Partnership	-

Table 6: Hypotheses verification

Figure 3 and Figure 4 shed lights on the reciprocal influence amidst the three IC components by passing through the Human Capital. Furthermore, it could be noticed that only SC and RC affected directly firm performance; this does not mean that HC does not affect financial performances but just that it does not affect them directly. Several studies stated that Human Capital affects performances indirectly by acting chiefly on Relational and Structural Capital. The first study that confirmed this idea was the seminal work by [26], already described in the literature review section. Actually other studies confirmed the same thesis ([31], [58]). As a matter of fact, human capital has always been defined as the ability to address knowledge in several business contexts such as procedures and processes ([25],[60]).

It is noteworthy that firm performance could be considered as a linkage between IC components and firm value; in fact, only in the first timeframe considered by this work it has been found a direct connection between SC and firm value. As just argued this could mean that Intellectual Capital may have influence on firm value through an indirect relation passing from firm performance; thus, it is reasonable to suppose that Intellectual Capital helps to improve firm performance and as a consequence of it, even market value could be enhanced.

This latter linkage has been verified by the assessed relation between *Cash ROCE* and *MV/BV*, which confirms that market value could be enhanced if a company got a good operating margin (EBITDA) in relation to its investments (Capital Employed). Figure 5 displays what it has just described:

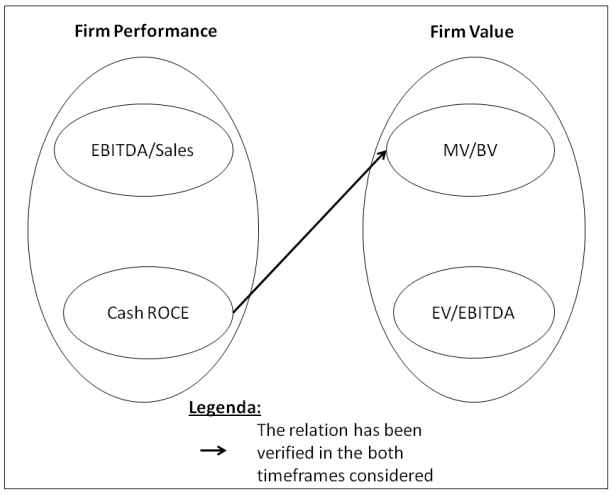

Figure 5: relation between firms' performances and market value

As it can be noticed, the analysis carried out shows a positive impact of the *Cash ROCE* on the market value; this suggests that if a firm achieves, year by year, a greater return for each monetary unit invested (consequently translated as an increase of its *Cash ROCE*), then it is more likely to be better evaluated by the market (with a higher *market value*).

6. CONCLUSIONS, IMPLICATIONS AND FURTHER RESEARCH

This study drew up two kinds of analyses, correlation and regression respectively, to investigate relationships among IC components, firm performance and market value, harvesting data of a sample of companies listed on Euronext 100 from Thomson Reuters DATASTREAM database.

The idea of this work was based on the consideration that the Intellectual Capital is a fundamental asset to get competitive advantage and therefore to compete globally in every market.

The main benefit emerging from this research was to highlight relations among IC, firm performance and market value; this could be useful, on the one hand, for scholars, to advance knowledge about the linkage between Intellectual Capital and Financial theories; on the other hand, for practitioners, to figure out how investments in Intellectual Capital should be addressed to get better financial performances and a greater market value.

Going more in depth, in terms of linkages amidst the IC components (HC, SC and RC), this research showed that SC and RC are linked to each other by means of HC; this means that HC can be recognised as a "bridge", the "intellectual bridge" (since HC is related to intellectual abilities of people) between structural and relational assets.

Further, since HC resulted as not directly linked to firms' performances and firms' value, it can also be acknowledged as a "booster" of the other two IC components. Investments into SC and RC directly contribute to firms' performances and, as a consequence, indirectly, to firms' value. As stated previously, it can be noticed that firms' performances could be considered as a linkage between IC components and firm value; hence, performances can be dubbed as "financial bridge" (since performances are linked to economic and financial measures and ratios).

Summarising, this research highlights the following concepts:

- Human Capital investments are the "intellectual bridge" capable of linking structural and relational capital investments;
- Human Capital investments act as a "booster" of structural and relational capital investments;
- Firm performance are the "financial bridge" between firm value and intellectual capital investments.

The research presented in this paper can be framed in the literature stream that found a positive relationship between IC and firm performance. This literature stream was already widely described in the literature section of this paper. Furthermore, the paper provides an additional deep distinction between firm financial performance and firm market value, by also investigating the relationship between each other. Finally, the paper provides an "internal" analysis of the three components of the IC (Human Capital, Structural Capital, Relational Capital), with the investigation of the relationships among them.

The paper contributes to research in both a theoretical and a practical point of view. From a theoretical point of view it has been demonstrated that investment in IC can improve performance; from a practical point of view firms are suggested to pay attention in their policy of investment towards the development of the internal IC, as they can positively impact on performance and also on market value. In particular the attention of firms should be pointed out on the variables that more directly impact on financial performance and market value, as already discussed in section 5.

Despite these benefits, some research limitations are listed below:

- It should be considered a larger sample; in fact, such results are referred to only 45 firms (despite finding data is not easy, due to the fact that there is not any standard way to disclose IC data);
- In this research, the authors analysed data by using tools like correlation and linear regression; however, there could be non-linear relations, which cannot be investigated through linear regression;

-
- Market value can be in general influenced by many factors such as market expectations or others. It is possible that the impact of market expectations on market value after 2008, due to the financial crisis, was more emphasized than before. This effect could have influenced our analysis. Further research can consider this aspect and can introduce specific variables able to “normalize” results.

Therefore, further studies could be carried out taking account of these limitations and then, they should consider a larger sample and also indicators not included in this analysis such as marketing expenses, investments plans in human capital (i.e. investment plans for employees), customer service expenses, customer satisfaction indexes, etc., which can be obtained by examining reporting documents drawn up by firms.
It should be investigated which factors are able to influence the Structural Capital, in order to provide guidelines to the firms and increase their value. Furthermore, other qualitative methodologies and tools to evaluate Intellectual Capital, based i.e. on surveys, need to be developed to get over limitations linked to financial statements data.
In conclusion, it could be argued that this research sheds light on implications that Intellectual Capital components could have on the process of value creation: a firm should pay more attention to the development of its Intellectual Assets as well as to its reporting system to have a clearer vision of its intangible assets on which it should be focused to get competitive advantage in this knowledge era.

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